Jurnal Tahap 1

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Building Critical Thinking Behaviour of Middle School Students through Project Based Learning

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Abstract

Innovation in learning is aimed to improve the quality of learning which can be recognized from students" performance and outcomes. One of the innovations which recently discussed is Project Based Learning (PBL) as one method to encourage students centered classes. There is increasing awareness in Indonesia to implement PBL in school across the country. It can be seen from the fact that Project Based Learning is promoted in the latest curriculum enacted in 2013. *Kurikulum 2013* is designed with Project Based Learning as an important part; as it is encouraged to apply PBL in all school level starting from elementary level. On the other hand, critical thinking as one significant element in Project Based Learning is not yet adequately addressed by educators in the formal pedagogy. The paper will examine critical thinking behavior of middle school students through project based learning and give suggestions on how to implement PBL which internalizes critical thinking.

As project-based learning allows students multiple options for taking information, making sense of any ideas, and expressing what they have learned, the writers believe that the precise moment to internalize critical thinking through this learning approach is at Middle School level. Klein, et al (2010) mention that at this age students have already experienced with subjects knowledge they receive in elementary school. They, then, suggest 5 (five) stages that have been developed in Division of Teaching and Learning Office of Curriculum, Standards, and Academic Engagement of New York; the stages are *establishing content and skill goals*, *conducting instructional activities*, *developing formats for final products, planning the scope of the project* and *assessing project design*.

The objective level of Bloom"s education taxonomy which later called as critical thinking puts efforts on analyzing, synthesizing and evaluating. The ongoing process of PBL directly leads students to work on those three dimensions. To measure students" critical thinking on PBL, teachers can apply either holistic or analytic; it could be in grid or rubric.

Keywords: Project Based Learning, Critical Thinking

BACKGROUND

Learning is a complicated process, because this experience will have different effect as it is delivered in different methods for different purposes. There are numerous methods in learning that have been designed by experts to meet teacher and learners" goal. One of innovations in learning method is Project Based Learning to enhance students" independence. In regards to that, critical thinking is a concept that play significant role in shaping students" performance to work independently, without highly relying on the teacher"s role in traditional classes. Given that the concept of critical thinking is a relatively strange for Indonesian context, a study in critical thinking is essential to explain the appropriate method in learning that internalized critical thinking on its process. The paper will examine how critical thinking is improved in Project Based Learning (PBL) and it will also give suggestions on how to build critical thinking behavior and the activities caveat the PBL can be implemented with critical thinking in Indonesian context.

Kurikulum 2013 is developed to answer new challenges in *digital era* as well as to commemorate the 100 years of Indonesia Independence in which learning activity is not indicated by pouring of what teacher"s knowledge to student"s brain but it is more as student"s investigation actions to what new knowledge poured into their brain. Kurikulum 2013 is also mentioned as the sustainability of the two previous curriculums, *Kurikulum Berbasis Kompetensi (KBK)* and *Kurikulum Tingkat Satuan Pelajaran (KTSP)* that all lessons must be reflected onto shaping student"s creativity, attitude, knowledge and spiritual. As learning model of Kurikulum 2013 counts heavily on students activities, it requires a standard of student"s competence that is able to be active, cooperative, interactive, and open-minded on real case investigation by utilizing all technology devices. The learning process appears to challenge students thinking creativity that reflects on series of scientific and contextual approach such as observing, questioning, associating, experimenting, and networking.

It is inevitably that today"s children are born with technology, so that Prensky (2002) called them as digital native people. This label experiences them with a high-quality of utilizing technology for any purposes (education, games, etc), no wonder we could see them very skillful operating any types of *smart phone*, computerized software or at least they are able to employ internet. By considering this reality, students are supposed to have critical thinking ability to

filter any kinds of information which they receive. Unfortunately, the activity to excavate students‟ critical thinking ability in Indonesia is still low. There are four models of learning that will sharpen students creativity, they are scientific model, discovery and inquiry model, problem based learning and project based learning. Scientific learning will facilitate students with knowledge of observing, questioning, associating, experimenting and networking in which the position of teacher isjust as a facilitator. To identify students understanding, discovery or inquiry learning is applied that teacher mobilizes students to discover their findings through teacher‟s questions possibly modified by teacher that later students could be a problem solver. Problem based learning, on the other hand, is presented through contextual to stimulate students learning as well as resolving problems appeared in the real world. Project based learning is the topic that will be further explained as a learning model that is believed building students‟ critical thinking behavior.

Critical Thinking and Its Role

Learners in developing countries obviously have significant difference from learners in developed countries. Both learners will be highly influenced by condition in their environment which supports their learning experience. What happens in Indonesia also shows that the learning experience taking place in the country is influenced by cultural aspect. Moreover, in some East Asian countries, Confusian-based learning system plays an important role in shaping the learning experience (Biggs, 1997; Cadman, 2000). In fact, Indonesian learners will perform differently from learners from developed countries. Some studies (Exley, 2005; Pikkert & Foster, 1996; Reid, 1987) reported that Indonesian learners are characterized as passive, obedient and less reflective students. It is argued in the paper that the assumption is affected by cultural issues in Indonesia with Eastern culture. The next question that appears is: are Indonesian learners critical thinkers? Of course every individual will have different answer. According to Ruggiero (2012), there are seven characteristics to differentiate critical thinkers from those who are not. Firstly, critical thinkers recognize their weaknesses, so they know their limitation and they are honest with their abilities; while uncritical thinkers are likely to ignore their weaknesses so that they pretend to know more than they do and assume that they have unlimited knowledge. The second characteristic of critical thinkers can be seen from their assumption on problems that they regard

as stimulating challenges. On the other hand, noncritical thinkers view problems and controversies as an irritating threat to them. Thirdly, critical thinkers can be identified from their attitude towards complexity that they keep their curiosity and invest their time in answering the confusing questions. Conversely, uncritical thinkers remain in their confusion because they are impatient with difficulties. The fourth aspect to identify critical thinkers is they judge something based on evidence, not by their personal judgment. It means that critical thinkers may also revise their perception or judgment if they find out that there is contradiction with the latest evidence. In contrast, uncritical thinkers do not concern on evidence because they heavily put their personal judgment.. In this regard, Egege and Kutieleh (2004) argue that South-East Asian students are commonly considered as non-critical particularly when they have to examine academic texts because they have weaknesses in analyzing and criticizing academic texts.

So what is critical thinking? „Father" of modern critical thinking, John Dewey, who is an American philosopher and also an educator, has defined critical thinking as "active, persistent and careful consideration of a belief or supposed form of knowledge in the lights of the grounds which support it and the further conclusions to which it tends" (in Fisher, 2001). The definition highlights words "active, persistent and careful consideration" which implies a thinking process in evaluating something. Furthermore, it is also mentioned that there will be conclusion drawn at the final process. A widely used definition by Robert Ennis provides a clear description of what a critical thinking is. Robert Ennis (in Fisher, 2001) defined critical thinking as "reasonable, reflective thinking that is focused on deciding what to believe or do". The definition states a reasoning skill as important aspect in critical thinking so there are evidences on deciding our judgment. From three definitions of critical thinking by experts, the writer defines critical thinking as an evaluative thinking process to make a judgment based on evidences. The main point in the definition is the evaluative thinking which requires a balanced view towards certain issues or complexity.

It is believed that critical thinking play its important role as foundational skill to fulfill the needs in 21stcentury. The thinking skill is significantly demanded as it proves the quality of the human resources with adequate evaluation, problem solving and reasoning skills. The ability to think critically helps individual to face challenges in the future in many different aspects such as social, cultural and economy.

Project Based Learning

Project based learning is a method which utilizes project as the core activities. It means that the learning experience is done through the sequences or processes in accomplishing a project. In other words, project is the tools in learning (*Model Pembelajaran Berbasis Proyek (Project Based Learning)*, 2013). In their work, Stripling, Lovett, and Macko (2009) identified Project Based Learning as " the instructional strategy of empowering learners to pursue content knowledge on their own and demonstrate their new understandings through a variety of presentation modes". They further characterized PBL as an inquiry process which is started by having important questions or ideas which have distinguished approach based on the student needs and interest. Moreover, PBL takes place when the students are engaged in a real world and authentic materials which encourage them to use their creative and critical thinking along with information skill that they need in investigating, creating content and drawing conclusion (Stripling et al., 2009).

In second language learning, PBL was introduced about two decades ago as one way to enhance student centered classes (Hedge, 1993 in Beckett, 2006). The transformation from teacher centered to student centered classes promotes project based learning because roles of both teacher and students change. Furthermore, Project Based Learning is not a new method in Indonesian context, because in junior high school, students are given guidelines in accomplishing projects in various school subjects, such as in Biology, Science, Chemistry, etc. The latest curriculum enacted in 2013 emphasizes PBL as one of important aspects in learning. In the curriculum, PBL is suggested to be applied in any school level starting from the elementary one. However, the implementation of Project Based Learning is not yet adequately exposed to students because the number of projects given to students is still considered very few. It is expected that by acknowledging the advantages of Project Based Learning for both teacher and students, teacher would invest their teaching time for Project Based Learning.

In accomplishing the project, students approach in multidisciplinary perspectives. For example, when the project is given in Biology class, the students analyze not only within the view point of Biology, but also in economics, or social science. Furthermore, writing and communication skill are highly demanded as the language they have produced in the report is an essential aspect to consider. Accordingly, PBL requires more efforts from students and teacher

compared to that of in traditional classes. This may be seen as one of challenges in implementing PBL into classes.

Challenges for teacher in implementing PBL are varied from attitude, time management, resources, and expertise. Time management in the classroom is the first challenge because the teacher needs to set fixed schedule for the project to be accomplished. The issue is recognized in the case study reported by Tamim and Grant (2013). They assert that it is not easy for teacher to cover all the necessary materials and contents within the time frame. As a facilitator who supports learners' experience in PBL, teacher needs to have a clear time frame so that the students are able to control and manage their time well. The challenge about having a fixed time frame can be tricky compared to traditional classes. In traditional classes, the designed schedule is likely to set; while in PBL classes, some flexibility needs to be considered so the scheduled time needs to anticipate the unexpected issues such as limited sources, difficulties in students' coordination, etc.

Not only teacher, students will also experience some difficulties. The first challenge for students is regarding educational resources. Resources will not matter for students who are able to access educational facilities such as books, magazines, internet, etc. Given that Indonesia as a developing country is struggling to provide adequate education for the people, educational facilities across the country are varied from the hi-tech to the least sophisticated. It means that there are students who have limited access to educational resources that will affect effectiveness of PBL. Concerning on this, Grant (2011) reported in his case study that the insufficient amount of information is frustrating for students in PBL. As the second challenge, students need to struggle to have good communication and collaboration skills. Working on a project will be challenging for those who have weaknesses in communication and collaboration. It is due to the fact that PBL is conducted via collaborative inquiry which requires a strong communication skill among the members of the group. Students with weak communication skill are given opportunity to improve their skill because they need to report the progress every certain period of time. Moreover, PBL will also increase collaboration skill because the projects need to be accomplished by teamwork. It is a chance for students to work in team, organize their work together and have the sense of belonging within the group.

Project Based Learning Enhances Critical Thinking

PBL indeed brings positive impacts for both teacher and students. Some studies have examined the advantages of PBL for the learning outcomes. For example, a study conducted by Noe and Neo (2009 in Tamim & Grant 2013) indicates that there is significant improvement on the students‟ communication skills, presentation skills, students‟ interest, collaborative skills and critical thinking in PBL. Moreover, PBL will also encourage students in a certain manner such as self-esteem and confidence (Katz & Chard, 1992 in Tamim & Grant 2013). The students‟ self esteem is important as they will perform at best when they are confident in doing something. Focusing in different aspect, Hernandez-Ramoz and Pas (2009 in Tamim & Grant 2013) reported that students in PBL were more motivated in learning and they were able to work collaboratively to explore the information, not only reporting the facts but also interpreting the information. Some of these findings have shown the importance of Project Based Learning not only for the students‟ outcomes, performance, but also behavior.

As it has been mentioned, Project Based Learning improves critical thinking. There are three important points of how critical thinking can be improved by having PBL. Firstly, PBL enhances critical thinking because the shift of teacher"s role as facilitator has created a students‟ centered class in which the students are exposed to have higher cognitive thinking. It is challenging function for a teacher to progressively support and facilitate the students‟ learning experience over a period of time. Teacher is expected to create a positive environment in the class so that the learners are provided with opportunities to ask and clarify questions, have a discussion in the class so they are active in mind (Leary, 2003).

Second, PBL promotes critical thinking since it is a collaborative activity in which the students work with classmates to answer complex questions and involve in inquiry process. During investigation process, students may find some difficulties and issues, so they can have discussion with their peers to solve the existing challenges. The process of collaborative inquiry is proven to enhance critical thinking because they are able to identify their limitation and make an effort to solve the problem collaboratively. Furthermore, it is easier for students to express their thoughts to their peers, rather than to the teacher. By having a project in learning experience, students will also improve their responsibility to take in charge of something. By doing so, they can also exercise their leadership skill. As the project highly demands collaboration, students are able to organize their work so they have a sense of responsibility on

the sections they are in charge of. Indeed, taking charge is an essential role of students as active learners (Stripling, Lovett and Macko, 2009).

As the third point, Project Based Learning is an effective method in increasing critical thinking because there is transformation of students' paradigm and behavior when they are learning in a real situation they are familiar with. Students are likely to be open-minded to different or even opposing ideas which are significant in Indonesia with diverse cultural background. As has been explained before, critical thinkers are able to appreciate others' perspectives; accordingly they tend to think objectively than subjectively. Project Based Learning enhances critical thinking because it exposes students with various ideas and students are „trained" to put their judgments based on evidences. There might be some arguments in the process of PBL; but this is the fun part of having a project in learning. Students need to put aside their subjectivity because they carefully draw conclusion based on evidences they have found during investigation process. In regards to this, Stripling, Lovett and Macko (2009) believe that "learning is social" which means that students are enthusiastic to share their ideas with their peers in learning. Further challenge in implementing PBL is to internalize critical thinking concept in PBL in classroom activities.

Critical Thinking and Project Based Learning in Kurikulum 2013

For a while, in 2013, the application of *Kurikulum 2013* is limited on class IV of Elementary School, class VII of Junior High School and class IX of Senior High School and it will be implemented completely to all levels of school in 2014. This study is limited on the implementation of critical thinking activity through Project Based Learning process for class VII of Junior High school. Teacher could encourage critical thinking ability through Project Based Learning by considering at least four stages; they are planning, organizing processing and evaluating. Klein, et al (2010) applied the similar stages in their paper entitled "Project-Based Learning: Inspiring Middle School Students to Engage in Deep and Active Learning" by deriving the four-concept into five steps of activities. The first step is *establishing content and skill goals* in which this activity will design theme of a project through building up several questions of comprehension as well as leading students to mind map their framework of thinking. The second step is *developing formats for final products* which transfer the answers questions into a production activity by considering familiar context of students. To avoid losing

the data, students are suggested to create a portfolio of their project. The third step is called *Plan the Scope of the Project* in which this activity caters the detail sequence of students' activities started by organizing task activities, designing model of assessment, analyzing the final product, and creating the details timeline. The last 2 steps are *Designing Instructional Activities* that involves teacher to scaffold students comprehension through simulation. This phase also introduces the rubric of evaluation that will help students to assess their project. The last phase is called Assessing *Project Design* or prompts reflections rubrics which contain several analyses questions about the project goal, collaboration, instructions, resources and technology, environment, final presentation and celebration while students conducts their project.

The objective level of Bloom's education taxonomy which later called as critical thinking puts efforts on analyzing, synthesizing and evaluating. This definition is then comprehensively expanded into several criteria of testing critical thinking. Paul and Elder (2009) mention standardized criteria of critical thinking that generally caters concepts of inference, induction, deduction, interpretation, analysis, synthesis, credibility, missing premises, argument analyze, equivocation avoidance, irrelevance, circularity, overgeneralization and excessive skepticism. Northeastern Illinois University issued an article about measuring critical thinking to scale student's proficiency. This article certainly breaks the simplest idea on criteria of measuring critical thinking in general that later will be used for evaluating student's achievement. The criteria are 1) identifying and explaining issues, 2) distinguishing types of claims, 3) recognizing stakeholders and contests, 4) considering methodology, 5) framing personal responses and acknowledging other perspectives, 6) reconstructing arguments, 7) interpreting content, 8) evaluating assumptions, 9) evaluating evidence and 10) evaluating inferences (NEIU, 2006). This concept of marking critical thinking then expanded through holistically and analytical measurement. Chase (1999) in Craig (2006) points out that holistic rubrics is required when assessing performance tasks in order to create some sort of response while analytic scoring. Holistic scoring also can tolerate errors on some parts. While analytical is mostly focused on response in which analytical is more stronger in profiling student's strength rather than in holistic scoring. In conducting scoring for critical thinking, teacher can apply both types of rubrics, yet they have different purposes. On the other hand, Ennis (2001) mentions that in scoring critical thinking, the test maker is able to

design their own critical thinking rubrics, yet it is recommended to use open-ended style as it will not lead you to a complicated judgment.

Table 1. The illustration of student's Activity in Mathematics Subject

Subjects	Kurikulum 2013 concept	Project Based Learning Procedure	Project Based Learning Activity	Critical Thinking Strategy Activity
	a. Focus on real life activity b. Focus on procedure (algorithm) c. Formula must not be drilled d. Create Formula Model	Establishing Content And Skill Goals	Designing questions to gain information about the price of particular fruits from different sellers	
		Developing formats for final products	Filing, comparing, and the variety prices of particular fruits , determining numbers of capital to gain particular amounts of profit	
Mathematics (Transactions Activity in Fruit Market)		Plan the Scope of the Project	Implementing strategy of selling. For example, with same amounts of capital students try to compare the profit they will get if they sell 2 mangoes with high price but low profit to 2 mangoes low price but high profit	DEAD ON* instruction
		Designing Instructional Activities	Formulating symbol of mathematics formula to count profit percentage For example: H1 = mango (A) H2 = mango (B) P = percentage	
		Assessing Project Design	Comparing the instruction concept and scoring rubric	DEAD ON answered checked on Critical Thinking

				Scoring Rubric (Holistic or Analytic)

Conclusion

The recent curriculum, that is Kurikulum 2013, accidentally require students to be an active learner as there are four model of learning that later will be applied completely. Project based learning, as one of the learning models, is believed to support students behavior in building their critical thinking capacity. Project based learning guides students to inquire knowledge as well as create a new model of knowledge. Though some believe that project based learning is time and money consuming, teacher could use their creativity to design a simple project learning for students. This also reflects on their critical thinking subject, that scoring could be in holistic and analytic or self-designed or self-design, that is by completing the criteria of critical thinking scoring rubric.

* **DEAD ON** is a game consists of questions series that leads students to deep thinking in their project activity (http://www.alfaroteachsmart.com)

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